SUTORBILT
ROTARY positive Blower
MODEL   SERiAl NO.
GACMDPA   S044 127
CATALog NO.
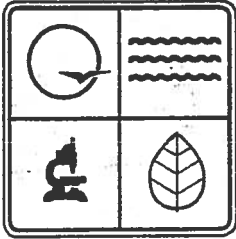4 MP   MAX RPM
                3600

DAN Leyland
891-4369

① MLSS
   High Sludge Age
②

① Other Basin going
② Seals try out in motive pumps
③ Backflush, air orfices. Nesselles
④ motive pumps.
   Every 5 years change out
   Impeller, harden Impeller
   Possible new   Alloy →
                Seals Repared on Pumps

Both Ditches

1.2 lB of O² / lB.
250mgL - Bod

TKN 40mgL

Both Ditches

Chemical Basin
at Influent
Odor Control

Both Ditches

19 feet of depth
O2 Transfer.
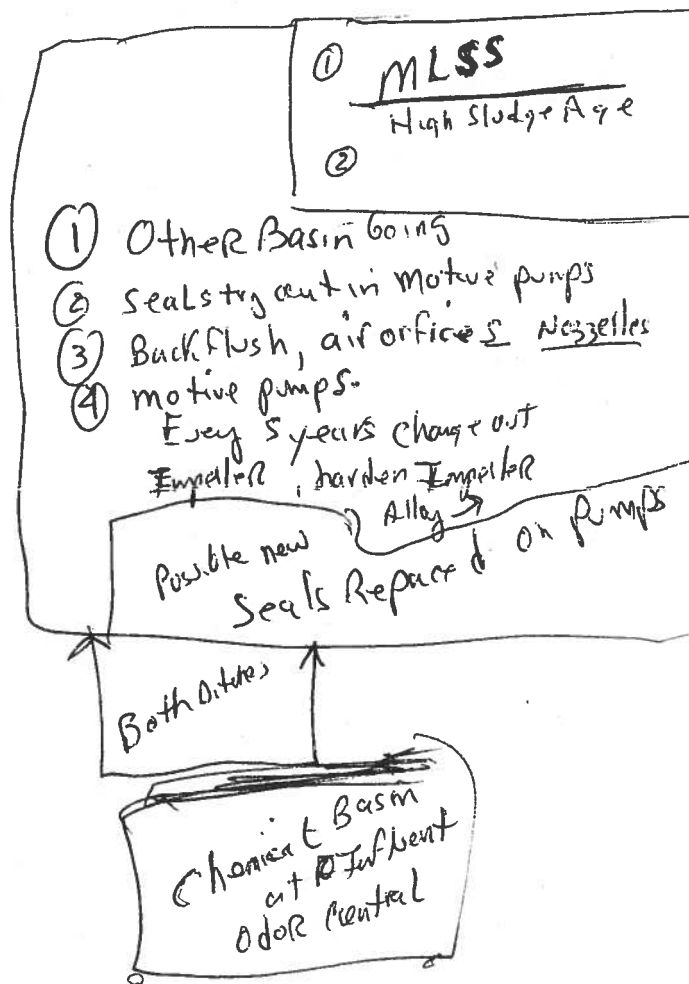
Missouri Department of Natural Resources

FAX TRANSMITTAL
Cover Sheet

TO: _Buck_

DATE: _6/28/07_

CO.: _City of Rockaway Beach_

DEPT.: _Utilities_

FAX #: _417-561-6025_

FROM: _Don Leyland_

MISSOURI DEPARTMENT OF NATURAL RESOURCES
SOUTHWEST REGIONAL OFFICE
2040 WEST WOODLAND
SPRINGFIELD, MO 65807-5912
Phone # 417-891-4300
FAX # 417-891-4399

COMMENTS _Hello Buck:_ ~~today~~. _Hope your doing good_
today. Here is the Suturbilt blower Performance Data.
~~Fax~~ _Please wait to order a different size blower until_
We have discussed the numbers
Thanks Dan

Total number of pages sent were _____ (including cover sheet).
If all pages are not received, or if problems are experienced, please call <u>417-891-4300.</u>

Hello Buck:

On Wednesday, May 23, I talked with Vance Neal of Larken Inc. in Kansas City about the problems at the plant.

Vance informed me that routine tests could be conducted on the motive pumps to see if they are operating properly. Below are the procedures that should be followed.

1. Turn pump on.
2. Keep Air on.
3. See how far Jet Plume extends.
4. Jet Plume should extend out 10-15 feet in basin.
5. If the jet plume ends right after it leaves the pipe, the impeller should be inspected. The impellers can wear out in as little as five years.

I explained to Vance, that the DO tests that we did in the aeration basin, revealed a DO of less than .4 mg/l. To increase the DO in the aeration basin, as a temporary measure, two blowers can be operated at the same time. The DO should be brought up to at least 1.0 mg/l as a starting point.

In closing, thank you and Terry for your hard work in trying to get these problems resolved. Have a good Holiday

Dan

Fax Cover Sheet

CITY OF ROCKAWAY BEACH
BOX 315
Rockaway Beach, Missouri 65740
(417) 561-4424 Phone / 561-2904
(417)561-6025 Fax
rockawaycity@interlinc.net E-mail   593·1546 -cell

Send to:	From:
DAN LEYLAND	BUCK GODLEY
Attention:	Date:
Office Location:	Office Location:
Fax Number:	Phone Number:

☐ Urgent
☐ Reply ASAP
☐ Please comment
☐ Please Review
☑ For your Information

Total pages, including cover: 5

Comments:

Design gassing rate	=	25	SCFM / jet		0.71 m^3/min/jet
Site gassing rate	=	25	ICFM / jet		0.71 m^3/min/jet
Absorption efficiency	=	27.5	%		
Design air flow	=	196	SCFM		5.56 m^3/min
Jets required per basin	=	8			
Aerators per basin	=	4	Type : C		
			Orientation : L		
Jets per aerator	=	2			

B = BDM, C = CM
L = Lgth, W = Wdth

V. BLOWER DESIGN CALCULATIONS:

Operating blowers	=	1	per basin	
Type of Blowers :	=	1		

1 = Rotary, positive displacement
2 = Multistage Centrifugal
3 = Variable-vane centrifugal

Total Number of Blowers	=	3	including a spare	
Air flow per blower	=	196	SCFM	5.56 m^3/min
Avg. barometric press.	=	14.31	psia	98.67 kPa
Inlet losses	=	0.3	psig *	2.07 kPa
Net inlet pressure	=	14.01	psia (absolute)	96.60 kPa
Discharge piping losses	=	0.7	psig *	4.83 kPa
Static head + Aerator loss	=	8.11	psig average	55.91 kPa
Total discharge pressure	≈	9.11	psig average	62.80 kPa
Design ambient temp.	=	100	°F maximum	38 °C
		0	°F minimum	-18 °C
Site air flow required	=	218	ICFM average	6.19 m^3/min
Equiv. sea level pressure	=	10.24	psig average	70.59 kPa
Nominal blower efficiency	=	61	% *	
Blower BHp/aerating basin	=	11.8	BHp	9 BkW
				10 kW @ 90% ME

(*notes assumed values, which may need to be confirmed)

VI. PUMP DESIGN CALCULATIONS:

Number of pumps	=	2	per basin
Type of Pumps :	=	2	
Total number of pumps	=	5	
Flow per pump	=	735	GPM
Required jet head	=	17	ft.
System headloss	=	3	ft.*
Total pump head	=	20	ft.
Assumed pump efficiency	=	68	% *
BHp per pump	=	5.5	
Total pump BHp/basin	=	11.0	

1 = Dry Pit Centrifugal
2 = Submersible Centrifugal
3 = Submersible Propeller

46 l/s
5.22 m
0.91 m
6.14 m

5 KW
8 BkW
9 kW @ 90% ME

VII. AERATION SYSTEM SUMMARY:

Standard Oxygen Required	=	2,682	lbs./d
Avg. BHp for 24 hrs.	=	46	BHp**
Assume Cost of Power	=	0.05	$/kW
Max. Annual Cost of Power**	=	16,538	$/yr, (assuming 90% motor efficiencies)

1219 kg/d
38 kW
Daily Usage   906 kWhrs/d

(*notes assumed values, which may need to be confirmed)

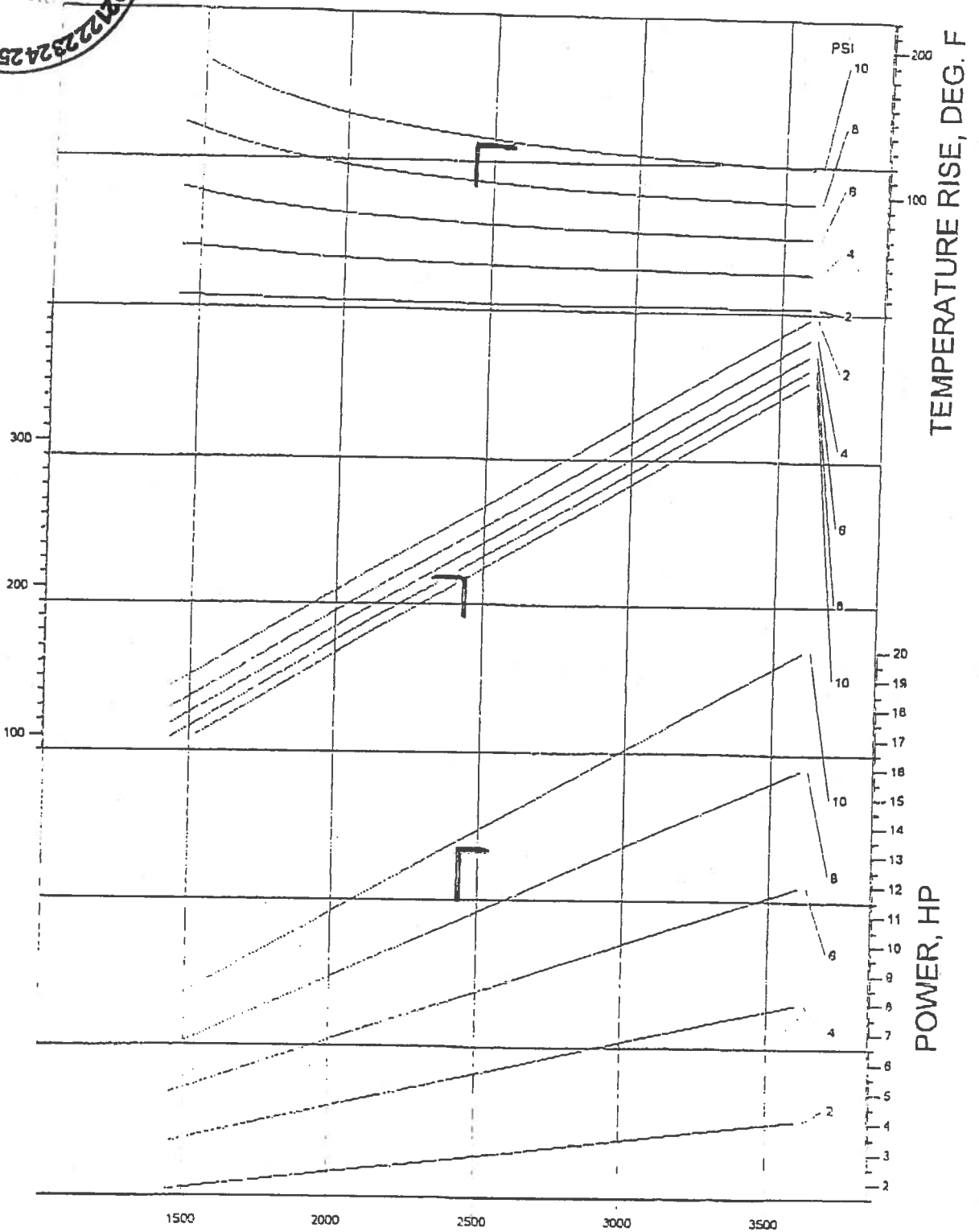# SUTORBILT LEGEND™
MODEL 4M
P-VERSION
PRESSURE PERFORMANCE CURVE
INLET AIR N2O2 AT 100 DEG F, 14.3 PSIA, SPECIFIC GRAVITY= 1.01
K= 1.3983   MW= 28.703   CP=0.24284

VERSION: 4.1
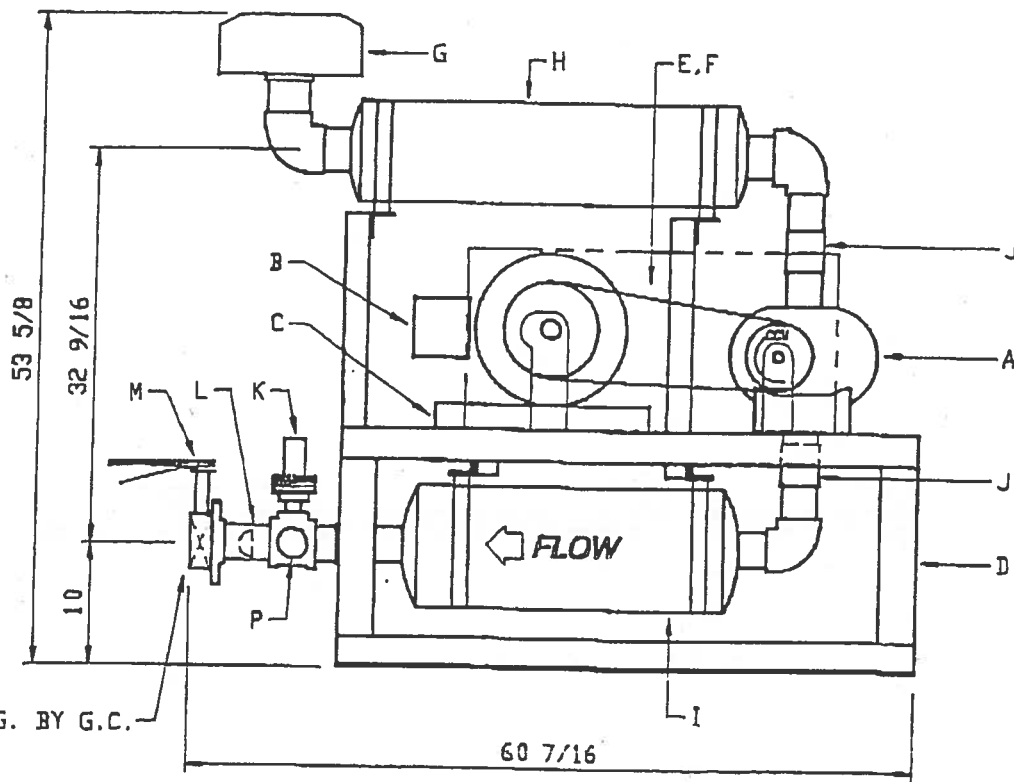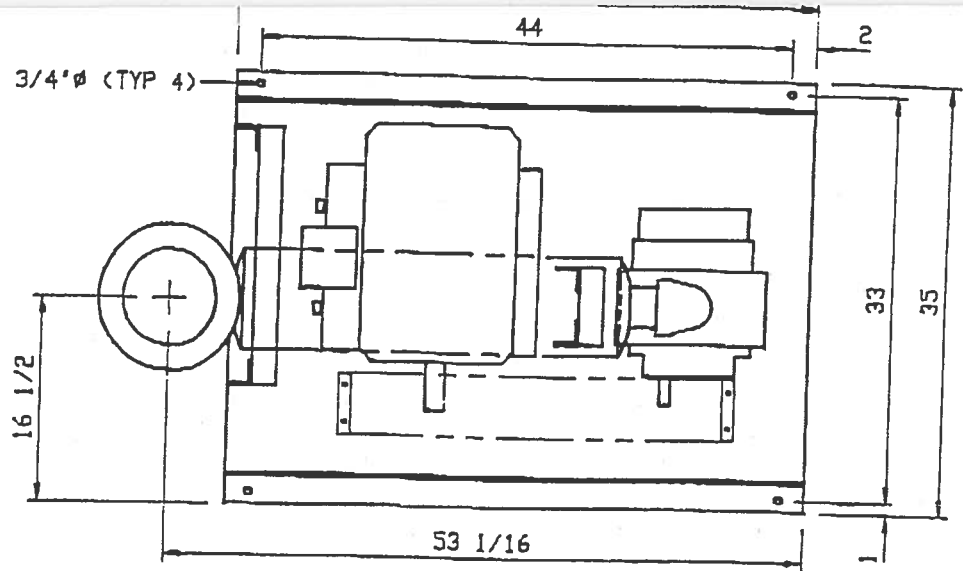DATED: 1-20-99
CUSTOMER:
QUOTE:

INLET AIRFLOW-CFM

TEMPERATURE RISE, DEG. F

POWER, HP

BLOWER SPEED - RPM

PSI
10
8
6
4
2

1500   2000   2500   3000   3500

44   2

3/4'⌀ (TYP 4)

16 1/2

33   35

53 1/16   1

53 5/8   32 9/16

G   H   E,F

B   J

C   A

M   L   K   J

10   D

P

2 1/2' 150# FLG. BY G.C.   I

60 7/16

RECEIVED
MAY 2007
FSD/SWRC

FLOW

A BLOWER: SUTORBILT 4MP, 196 SCFM / 217 ICFM, 2488 RPM, 9.2 PSIG
B MOTOR: 15 HP, 1800 RPM, TEFC, 254T, 230/460/3/60,
C MOTOR SLIDE BASE: 254-B2
D ELEVATED STEEL BASE
E V-BELT DRIVE
    BLOWER SHV: 3/3V5.6 - SDS x 7/8"
    MOTOR SHV: 3/3V8.0 - SK x 1 5/8"
    BELTS: 3VX600, CD = 19.3"
F BELT GUARD
G INLET FILTER: UNIVERSAL CCF-3", W. PAPER ELEMENT
H INLET SILENCER: UNIVERSAL RIS-3"
I DISCHARGE SILENCER: UNIVERSAL RD-2 1/2"
' FLEXIBLE PIPE CONNECTOR: X-L TYPE II
    RELIEF VALVE: PL-1", SET @ 10.0 PSI
L CHECK VALVE: TECHNO 5002-2 1/2"
M BUTTERFLY VALVE: TECHNO 6000-2 1/2"
P PRESSURE GAGE: WIKA 213.53, 0-15 PSI

ESTIMATED WEIGHT: 575 #

EXCELSIOR
Blower Systems Inc.
READING, PENNSYLVANIA

U.S. FILTER / JET TECH

BLOWERS FOR ROCKAWAY BEACH, MD - P.O. # HL18558

DATE: 1-20-99	SCALE: 3/4" = 1'
DRAWING A16	12170-1

May 18, 2007

Dear

This letter is in regard to a Missouri Department of Natural Resources visit to the
City of Rockaway Beach's wastewater treatment plant on May 10, and 17, 2007.
The visit was conducted based upon the Department's receipt of several inquires concerning
excessive odors being emitted from the plant from near-by homeowners.

The visit revealed that were three locations in the plant where odor emissions could be reduced.
The three locations are listed below, along with recommendations on steps that should be
considered to reduce the amount of odors being emitted.

1. **Central Mixing Chamber**
   Excessive odors were being emitted from the mixing chamber that receives the return
   activated sludge (RAS), and floating skimmer waste that originates from the plant's aeration
   basin. The RAS and skimmer waste are pumped back to the plant's headworks box. To
   help reduce excessive odor emission from this location, please insure that the aeration
   basin is supplied with the required amount of Dissolved Oxygen (DO) as described
   in paragraph Number 2 below. If excessive odors continue to be emitted, after the proper
   amount of (DO) has been made available to the aeration basin and the sludge management
   aspects of operating and maintaining the plant are in accordance with process control
   guidelines, the installation of external odor control measures may have to be considered.

2. **Aeration Basin**
   The plant is equipped with two (2) aeration basins that are designed to process up to 300,000
   gallons per day each. Currently, only one basin is in operation and is receiving approx.
   150,000 gallons per day of wastewater. A predetermine amount of dissolved oxygen,
   (DO), produced by properly sized blowers and air distribution systems, provide a sufficient
   Quantity of oxygen for the bacteria that are working aggressively to consume the incoming
   Organic wastes. If the proper amount of (DO) is not supplied to the aeration basin the
   wastewater will become septic which results in the emission of excessive odors and the
   discharge of a poor quality wastewater. The results of the dissolved oxygen (DO)
   tests conducted on May 10 and 17, 2007 revealed a (DO) concentration which averaged
   less than .4 mg/l. Operational control studies suggest that as least 1.0 mg/l of (DO)
   should be maintained at all times in an aeration basin that is preceded by an anoxic chamber.
   To insure that the proper amount of (DO) is provided to the aeration basin, please contact
   a Licensed Professional Engineer to evaluate the current (DO) production, distribution and
   injection system. If the existing system is not capable of producing the required amount
   (DO), please take steps to upgrade the system to meet current (DO) requirements.

3. **Sludge Holding Basin**
   The old raceway type oxidation ditch, formerly used by the City of Rockaway Beach
   is used to hold sludge. Odors from this location were detected during the visit. To help
   reduce the odors from this location, the plant's operator should work to determine the

(1-2 mg/l)
check on every day

Potas Pertassim Permanate
Hydrogen Peroxide

Hello Buck:

On Wednesday, May 23, I talked with Vance Neal of Larken Inc. in Kansas City
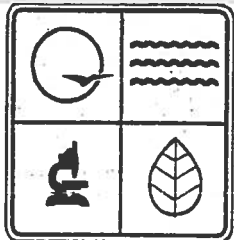about the problems at the plant.

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5. If the jet plume ends right after it leaves the pipe, the impeller
    should be inspected. The impellers can wear out in as little as five years.

I explained to Vance, that the DO tests that we did in the aeration basin, revealed
a DO of less than .4 mg/l.   To increase the DO in the aeration basin, as a temporary
measure, two blowers can be operated at the same time. The DO should be
brought up to at least 1.0 mg/l as a starting point.

In closing, thank you and Terry for your hard work in trying to get these problems
resolved.   Have a good Holiday

Dan

Missouri Department of Natural Resources

FAX TRANSMITTAL
Cover Sheet

TO: _Buck Godley_

DATE: _5/25/07_

CO.: _City of Kimberling_

DEPT.: _____

FAX #: _417-561-6025_

FROM: _Don deyland_

MISSOURI DEPARTMENT OF NATURAL RESOURCES
SOUTHWEST REGIONAL OFFICE
2040 WEST WOODLAND
SPRINGFIELD, MO 65807-5912
Phone # 417-891-4300
FAX # 417-891-4399

COMMENTS _Hello Buck._

Here is some info on the Motive Pump &
DO Problem. please Give me a call, If you have any questions or I can help
Thank Don

_____

_____

_____

Total number of pages sent were ___2___ (including cover sheet).
If all pages are not received, or if problems are experienced, please call 417-891-4300.

![apac logo]

APAC-MISSOURI, INC.

P.O. Box 1117 (65205) • 1591 E. Prathersville Road • Columbia, MO 65202
Phone (573) 449-0886 • Fax (573) 449-7966 • www.apac.com

.17 lB / person

5.88   1500 P.E   255 P.E

~~663,326~~

663,265.30
needed.

2600   1B

~~255 lBS~~

255 lBS.

1251 lBS of BoD / day x 1.20 lB of O_2/lB BoD =

1501 lB
O_2/day

228 c

5CFM   226
                    561 -   561-6025
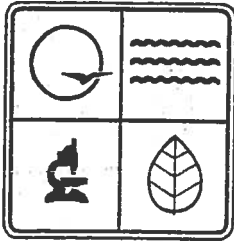   2   6025

Rockhaway

D.O.

Circular Aeration Basin

Aug   4 - 5

Looks to be small Blowers
only 1 running

Check CFM
Sutorbuilt

Missouri Department of Natural Resources

FAX TRANSMITTAL
Cover Sheet

TO: _Buck Godley_

DATE: _5/11/07_

CO.: _____

DEPT.: _____

FAX #: _417-561-6025_

FROM: _Dandeyland_

**MISSOURI DEPARTMENT OF NATURAL RESOURCES
SOUTHWEST REGIONAL OFFICE
2040 WEST WOODLAND
SPRINGFIELD, MO 65807-5912
Phone # 417-891-4300
FAX # 417-891-4399**

COMMENTS _Hello Buck. Here are the
3 pages of the manual I borrowed on Thurs.
I will send them back next week
Thanks
Dom_

Total number of pages sent were ___4___ (including cover sheet).
If all pages are not received, or if problems are experienced, please call **417-891-4300.**

RESULTS

AERATOR SIZING CALCULATIONS FOR:

ROCKAWAY BEACH, MO   LA No. KC97-3710.1000

Date: 03/03/98

DESIGN CRITERIA:

To convert from mg/l to lbs/day use the
following eq: mg/l x 8.34 lb/MG x Daily flow (MGD)

Flow :   0.600 MGD
BOD demand :   250 mg/l converts to   1251 lbs/day
TKN :   40 mg/l converts to   200 lbs/day

The basin volume is found using the following equation:

V = (detention time/24) x Q

Total Basin
Volume: 0.611 MG
Det.time: 1.02 Days

OXYGEN REQUIRED FOR BOD REMOVAL:

For this application we are using: 1.20 lbs of O2 for each
lb of BOD/day (under working conditions). A residual O2 level of
1.00   mg/l should be maintained in the pond at all times.

BOD Oxygen requirement calculation.
1251 lbs of BOD/day x   1.20 lb of O2/lb BOD =   1501 lbO2/day

TKN Oxygen requirement calculation:
200 lbs of TKN/day x   4.60 lb of O2/lb TKN =   921 lbO2/day

Credit Denitrification for removal of some Oxygen Demand:
2.86 lbs O2 demand can be credited per lb NO3 denitrified (62% theoretically can be recoved)
200 lbs of NO3-N/day   2.86 lb of O2/lb NO3-N =   572 lbO2/day

Actual Oxygen required (AOR) per day is the total of the BOD and TKN demands.
1501 lbs/day +   (921 -   572 lb/day) =   **1849** lbs O2
under   field conditions.

Oxygen transfer rates for aerators are reported under standard
conditions. In order to make proper comparisons under field conditions,
actual oxygen requirement (AOR) should be converted to standard
oxygen total requirement (SOTR). Conversion from field
conditions can be accomplished with the following equation.

$$SOTR = \frac{AOR}{\frac{(Beta \ast DO\ sat' - DO)}{DO\ sat\ @\ std.\ cond.}} \ast Alpha \ast Theta\,\widehat{}\,(T-20)$$

Where:

AOR = Actual oxygen requirement (field conditions)

SOTR = Standard oxygen total tequirements (standard conditions)

Standard conditions by definition are zero elevation (sea level), 20 degree C, and zero DO (dissolved oxygen in liquid), also includes 40% water depth.

Alpha = KLa wastewater/ KLa tap water

Beta = Salinity factor

Theta = Temperature correction factor = 1.024

DO sat @ std. cond. and avg. water depth = DO saturation at standard conditions (sea level and 20 C) and 40% water depth.

DO sat' = Saturation at a given altitude, temperature and 40% water depth.

1. At Temperature Maximum Where:

SOTR = Standard Oxygen Total Requirement (lbs/day)

AOR = Actual Oxygen Requirements lbs/day =	1849
Beta = Salinity, surface tension factors =	0.95
DO sat @ std. cond. and 40% water depth = $9.09*(1 + .4*D/34)$ =	11.12
DO sat' = Sat. at given altitude, temp max and 40% water depth =	9.84
DO = Residual oxygen mg/l =	1.0
Alpha = Oxygen transfer correction factor =	0.85
Theta = temperature correction factor =	1.024
Tmax = Maximum Operating temperature (C) =	25

$$SOTR = \frac{1849}{[(0.95 * \frac{9.84}{11.12 \text{ mg/l}}) - 1.0] * 0.85 * 1.024^{(25 - 20)}}$$

SOTR at Tmax = **2574** lbs of O2/day   (All the Plant)

Calculate air flow at standard condition:

Depth diffusser in basin (ft) =	19.0
Weight of air (lbs/cu ft) @ site elevation =	0.0746
Oxygen by weight is 20.9% of the weight of air	0.209
Total Diffuser Transfer Efficiency %:	25.40
Aeration Time (minutes/basin):	1440
Number of Basins:	2

$$SCFM \text{ per basin} = \frac{SORT}{Wt \text{ Air} * \%Oxy * Tran. \text{ Eff.} * Min \text{ of Aeration} * \#Basins}$$

SCFM per basin @ Tmax = **226**

ICFM = SCFM*.0276*T(DEG R)/(Pa-Rh*Pv):

ICFM per basin @ Tmax = **261**   (Uses Max. Air Temp)

2. At Temperature Minimum Where:

SOTR = Standard Oxygen Total Requirement (lbs/day)

AOR = Actual Oxygen Requirements lbs/day =	1849

Beta = Salinity, surface tension factors =   0.95
DO sat @ std. cond. and 40% water depth = $9.09*(1+.4*D/34)$ = 11.12
DO sat' = Sat. at given altitude, temp min and 40% water depth = 13.45
DO = Residual oxygen mg/l =   1.0
Alpha = Oxygen transfer correction factor = 0.85
Theta = temperature correction factor = 1.024
Tmin = Minimum Operating temperature (C) = 10

$$SOTR = \frac{1849}{[(0.95 * 13.45) - 1.0] * 0.85 * 1.024^{(10-20)}}$$
11.12   mg/l

SOTR at Tmin = **2605**   lbs of O2/day   (All the Plant)

SCFM per basin @ Tmin =   228   cu ft/min
ICFM = SCFM*.0276*T(DEG R)/(Pa-Rh*Pv):
ICFM per basin @ Tmin =   212   (Uses Min. Air Temp)

Design SCFM per basin =   228   cu ft/min
Design ICFM per basin =   261   cu ft/min

BRAKE HORSEPOWER FOR BLOWERS

$Bhp = wRT*((P2/P1)^n -1)/(33000*n*e)$
$Bhp = ICFM*.227*K$
   K = 0.151
   Bhp per basin = 14.0

BLOWER INFORMATION

Maximum Ambient Air Temperature (degrees F) = 100.00 F = 37.8 C
   Vp at Tmax = 48.35 mmHG = 0.935 psi
Minimum Ambient Air Temperature (degrees F) = 20.00 F = -6.7 C
   Vp at Tman = 2.79 mmHG = 0.054 psi
Maximum Relative Humidity (percent) = 100.00

TDH of Air System (psi) = 9.23 ****CHECK***

Blower Efficiency (percent) = 64.00